

Companies License NASA's Advanced Friction Stir Welding Technology



NASA Marshall Space Flight Center proudly announces the successful commercialization of its retractable pin tool for friction stir welding (FSW) by MTS Systems Corporation and MCE Technologies, Inc. Under license from NASA, both companies recently introduced products that use NASA Marshall's retractable pin tool for FSW process improvements.

The Licensees and Their Products

MTS Systems Corporation

MTS, a leading supplier of mechanical testing and simulation equipment, recently introduced an advanced friction stir welding process development system employing NASA Marshall's retractable pin tool. MTS's product is a flexible system that enables advanced FSW applications for high-strength structural alloys. The high-force, self-contained design includes a multi-axis weld-head manipulation system and a custom head assembly that incorporates the retractable pin tool.

The use of NASA Marshall's retractable pin tool in the MTS units has enabled FSW applications that are cost competitive, efficient, and versatile for automotive, ship-building, and other industries. Additionally, incorporation of NASA Marshall's pin tool technology into MTS's product has helped the company gain market share in the growing FSW niche and develop business relationships with several institutions. For more information on MTS's process development system, contact Mike Skinner via e-mail (mike.skinner@mts.com).

MCE Technologies, Inc. (MCETEC)

A provider of engineering and manufacturing services and equipment, MCETEC has developed a cutting-edge line of production stir welding equipment using NASA Marshall's retractable pin tool. MCETEC's production stir welding product provides flawless welds in virtually all FSW applications using high-performance aluminum alloys, including those previously considered unweldable. The incorporation of NASA Marshall's retractable pin tool in the design allows the pin angle and length to be adjusted for changes in material thickness and results in a smooth hole closure at the end of the weld.

The use of NASA Marshall's retractable pin tool in MCETEC's production stir welding product has contributed to advantages including minimal material distortion, lack of contamination, and greater joint strength for FSW applications in aerospace and other industries. Additionally, working with NASA Marshall has helped MCETEC remain a stable employer by improving its product offering to the FSW market. For more information on MCETEC's production stir welding equipment, contact Jim Whitehouse via e-mail (whitehouseja@mcetec.com).

Applications

The following are manufacturing applications for friction stir welding:

- Aircraft
- Aerospace
- Marine
 - Shipbuilding
 - Decks for car ferries
- Trucking
- Railroading
- Assembling large tank structures
 - Fuel tanks
 - Radioactive waste canisters

The Technology

Introduced and patented by The Welding Institute (TWI) in the United Kingdom, friction stir welding has been widely recognized for its ability to provide greatly improved weld properties over conventional fusion welds. During the FSW process, the pin of a shouldered tool is slowly plunged into the joint between the two materials to be welded and rotated at high speed. The resulting friction creates a plasticized shaft of material around the pin. As the pin moves forward in the joint, it “stirs,” or crushes, the plasticized material, creating a forged bond, or weld.

Although the FSW process is more reliable and maintains higher material properties than conventional welding methods, two major drawbacks with the initial design impacted the efficacy of the process: the requirement for different-length pin tools when welding materials of varying thickness and the reliance on a pin tool that left a keyhole at the end of the weld. The latter was a reliability concern particularly when welding cylindrical items such as drums, pipes, and storage tanks.

In exploring methods to improve the use of FSW on the manufacturing floor, NASA Marshall, a licensee of TWI's FSW process, created new pin tool technology, including an automatic retractable pin tool. The automatic retractable pin tool uses a computer-controlled motor to automatically retract the pin into the shoulder of the tool at the end of the weld, preventing keyholes. NASA Marshall's innovative retractable pin tool has contributed to customized FSW that has been proven to provide routinely reliable welds.

Benefits of Friction Stir Welding

- **Diverse materials:** Welds a wide range of alloys, including previously unweldable and composite materials
- **Durable joints:** Provides twice the fatigue resistance of fusion welds and no keyholes
- **Versatile welds:** Welds in all positions and creates straight or complex-shape welds
- **Retained material properties:** Minimizes material distortion
- **Safe operation:** Does not create hazards such as welding fumes, radiation, high voltage, liquid metals, or arcing
- **No keyholes:** Pin is retracted automatically at end of weld
- **Tapered-thickness weld joints:** Pin maintains full penetration

For More Information

The successful commercialization of the retractable pin tool technology resulted from NASA's technology transfer program. The program seeks to stimulate commercial use of NASA-developed technologies. If your company is interested in NASA's technology transfer program or friction stir welding, please contact

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